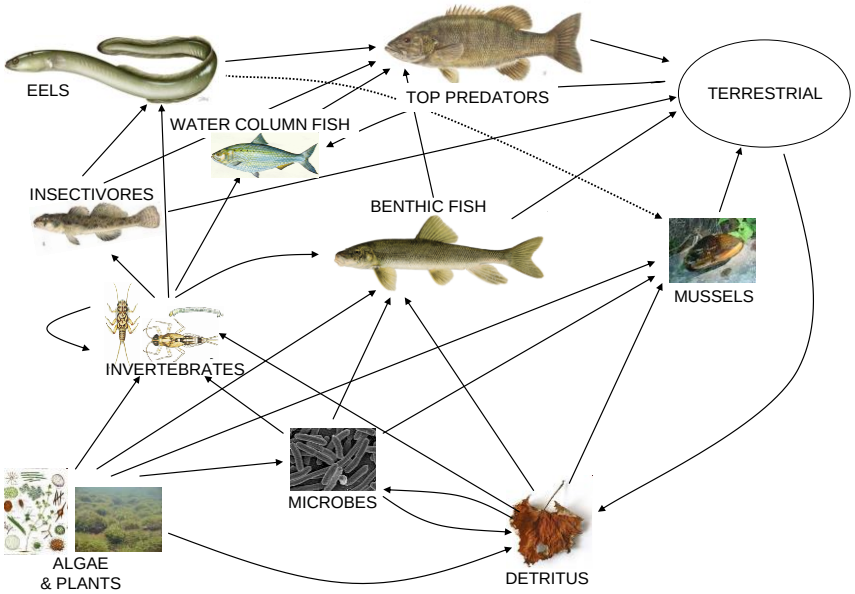
Bioassessment on the Delaware: Challenges & Approaches for a Large River



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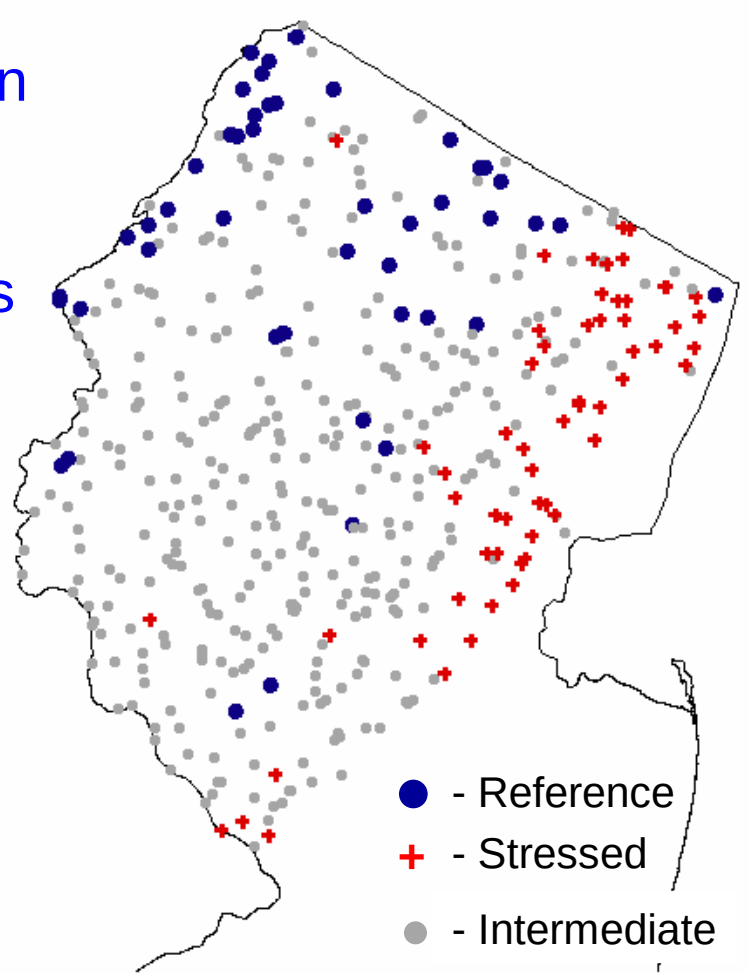
Delaware River Basin Commission
DELAWARE · NEW JERSEY
PENNSYLVANIA · NEW YORK
UNITED STATES OF AMERICA

Assessing Biological Condition

- **Lakes & Streams**: regional comparison works extremely well
  : similar processes & biological structure facilitate comparisons
  : Lakes have “historical” option



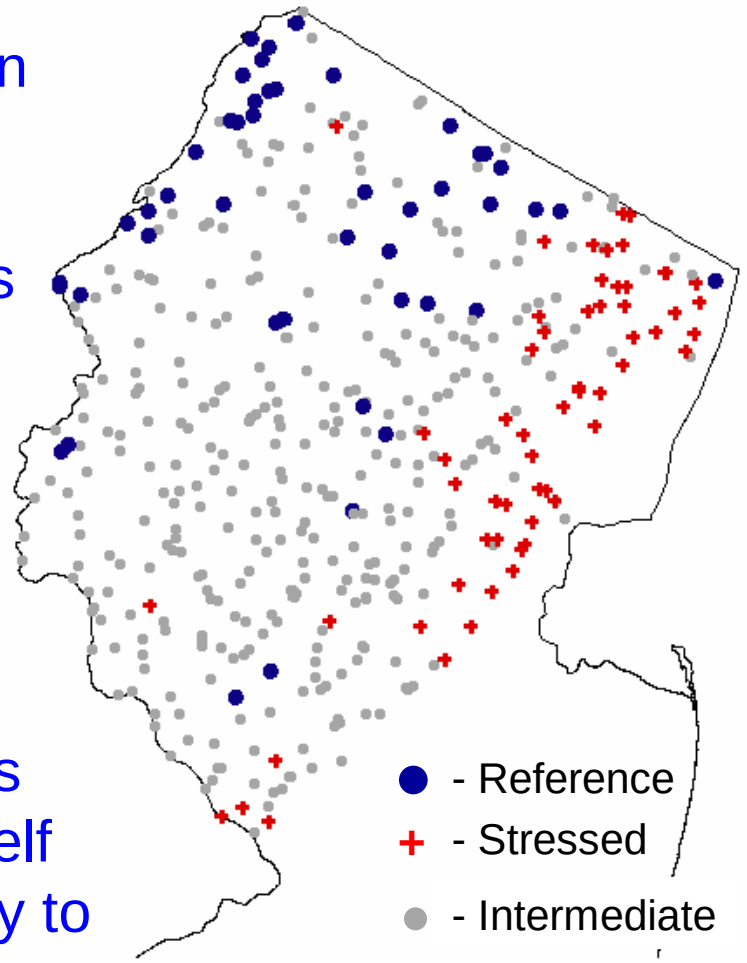
from NJDEP High Gradient Macroinvertebrate Index (Tetra Tech 2007)

Assessing Biological Condition

- **Lakes & Streams**: regional comparison works extremely well
  : similar processes & biological structure facilitate comparisons
  : Lakes have "historical" option

- **Estuaries**: highly unique
  : Delaware Bay not be appropriate comparison to Barnegat Bay

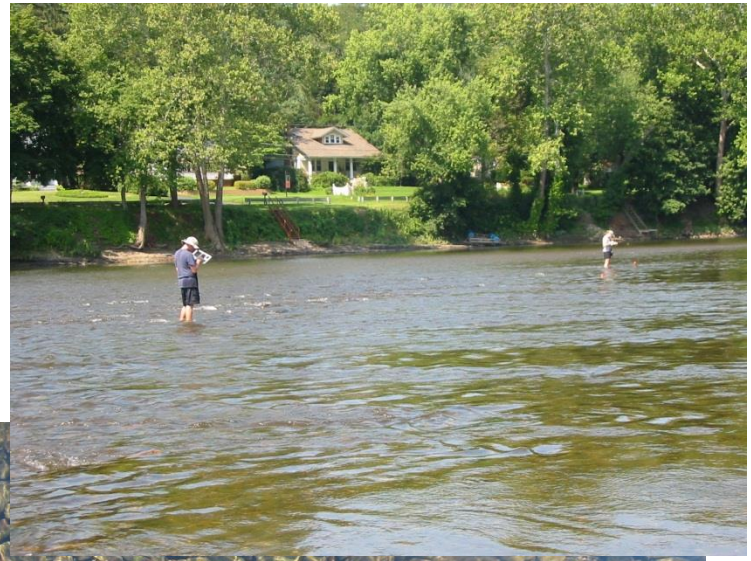
- **Large Rivers**: intermediate uniqueness
  : for Mississippi, only compare to itself
  : for typical river, may have the ability to use regional references

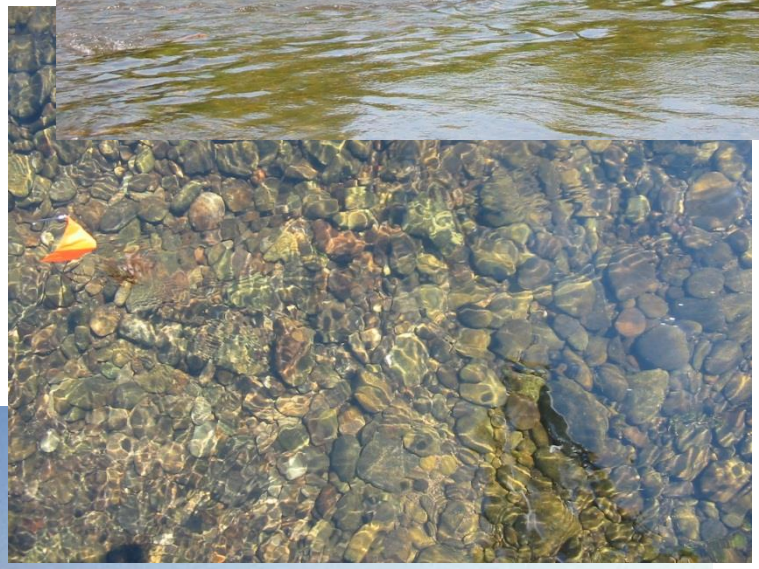


from NJDEP High Gradient Macroinvertebrate Index (Tetra Tech 2007)

Delaware River Characteristics

- Wadeable to head-of-tide
- Heavily dominated by rocky substrates
- High water clarity / high light
- Undammed on mainstem
- Drainage areas spanning 1500 mi^2 to 6700 mi^2
- High water quality
- National Wild & Scenic status





Invertebrate Biomonitoring

- Aug/Sept 2001-2012 surveys
- 25 stations
- Targeted riffle
  - → 1 – 3 ft/s
  - → 1 – 2 ft depth
  - → 40 – 70 mm median substrate
- Composite of 3 samples (4 ft^2)
- 500 individual target count
- genus-level taxonomy

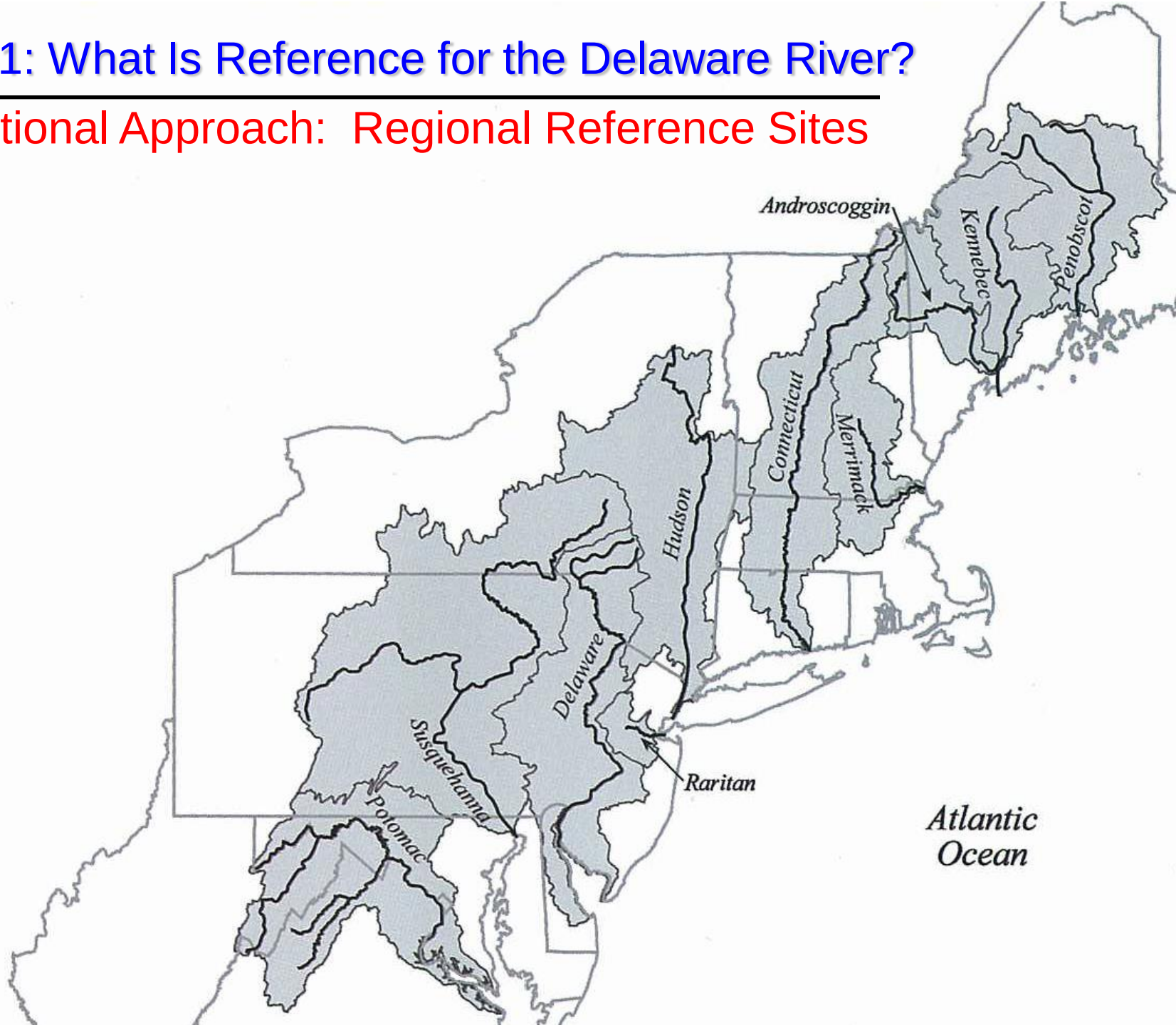
Issue #1: What Is Reference for the Delaware River?

Options

- Historical conditions
- Regional reference
- System-defined reference

Issue #1: What Is Reference for the Delaware River?

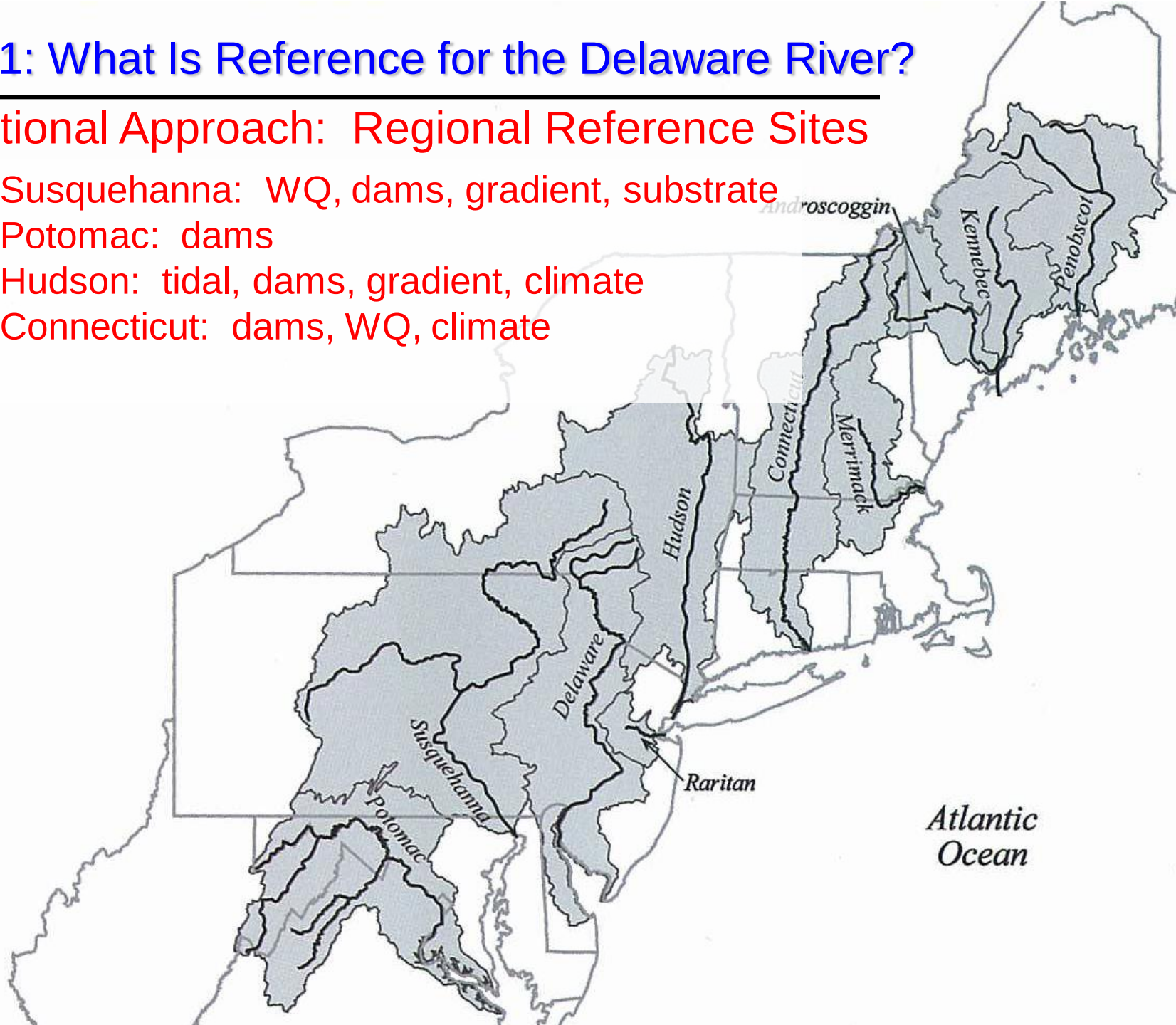
Traditional Approach: Regional Reference Sites



Issue #1: What Is Reference for the Delaware River?

Traditional Approach: Regional Reference Sites

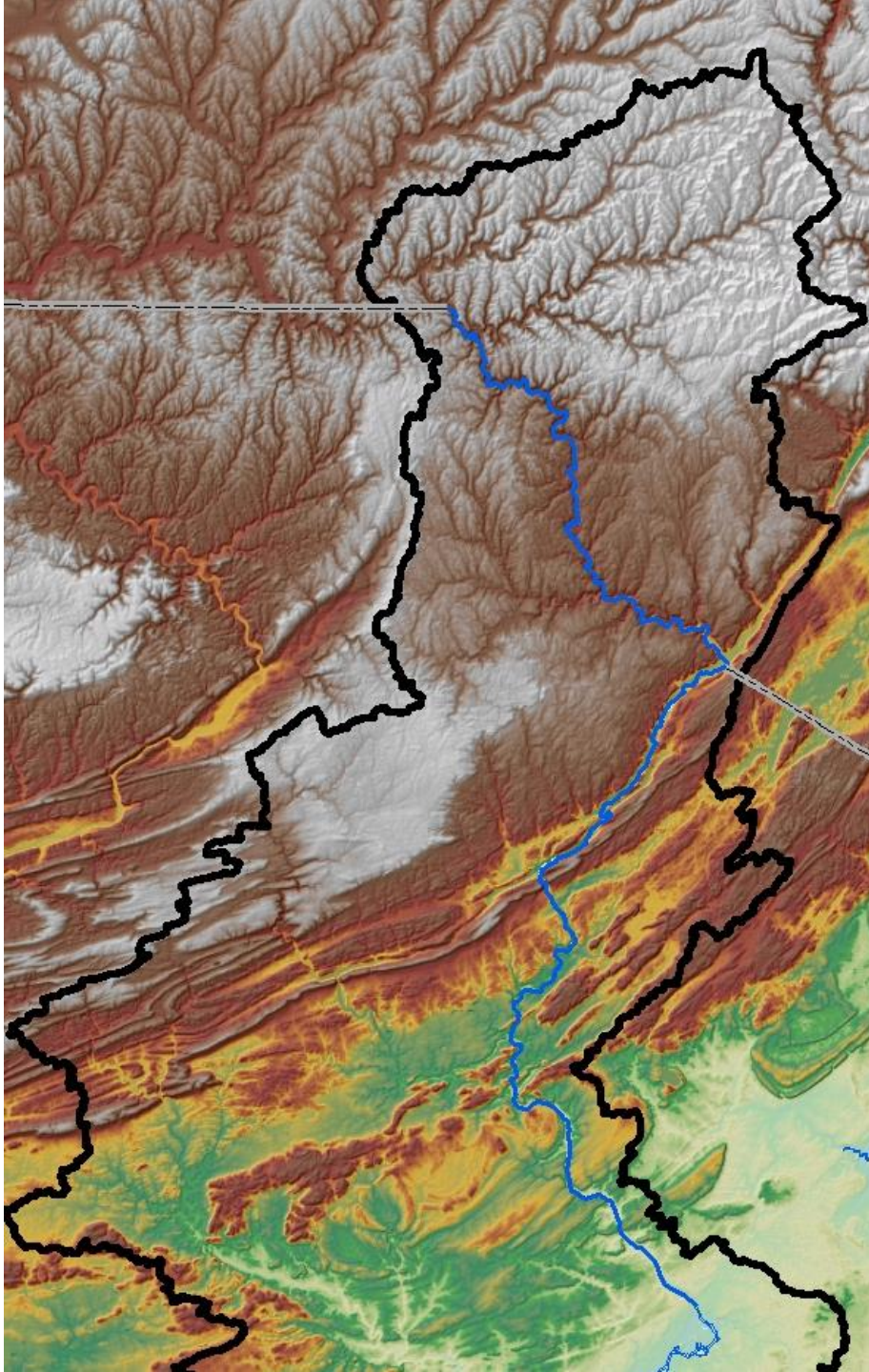
- Susquehanna: WQ, dams, gradient, substrate
- Potomac: dams
- Hudson: tidal, dams, gradient, climate
- Connecticut: dams, WQ, climate



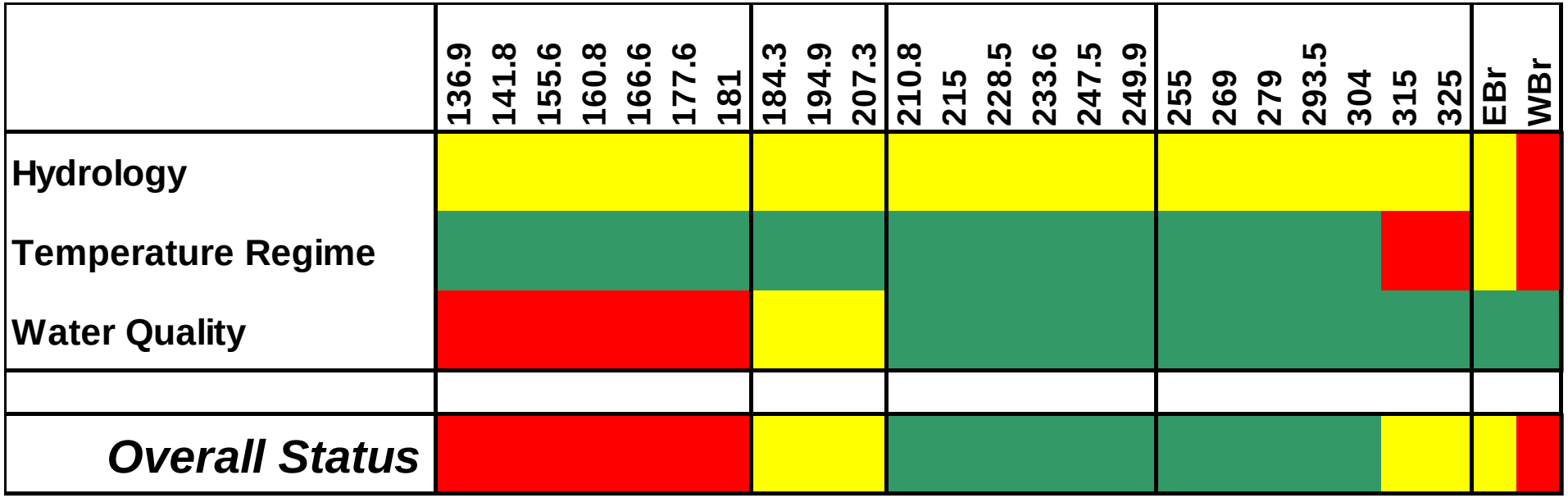
Issue #1: What Is Reference for the Delaware River?

Proposed Solution:
System-Defined Reference

- Unfortunately lacking historic data
- Use current conditions to define expectations
- Select least-disturbed segments
- Similar to Mississippi, other Great Rivers



Synthesizing Human Influence: **Major Stressors**



= Limited Human Influence

= Moderate Human Influence

= Strong Human Influence

Issue #2: Measuring Stress and "Too Much" Ecological Change

Options

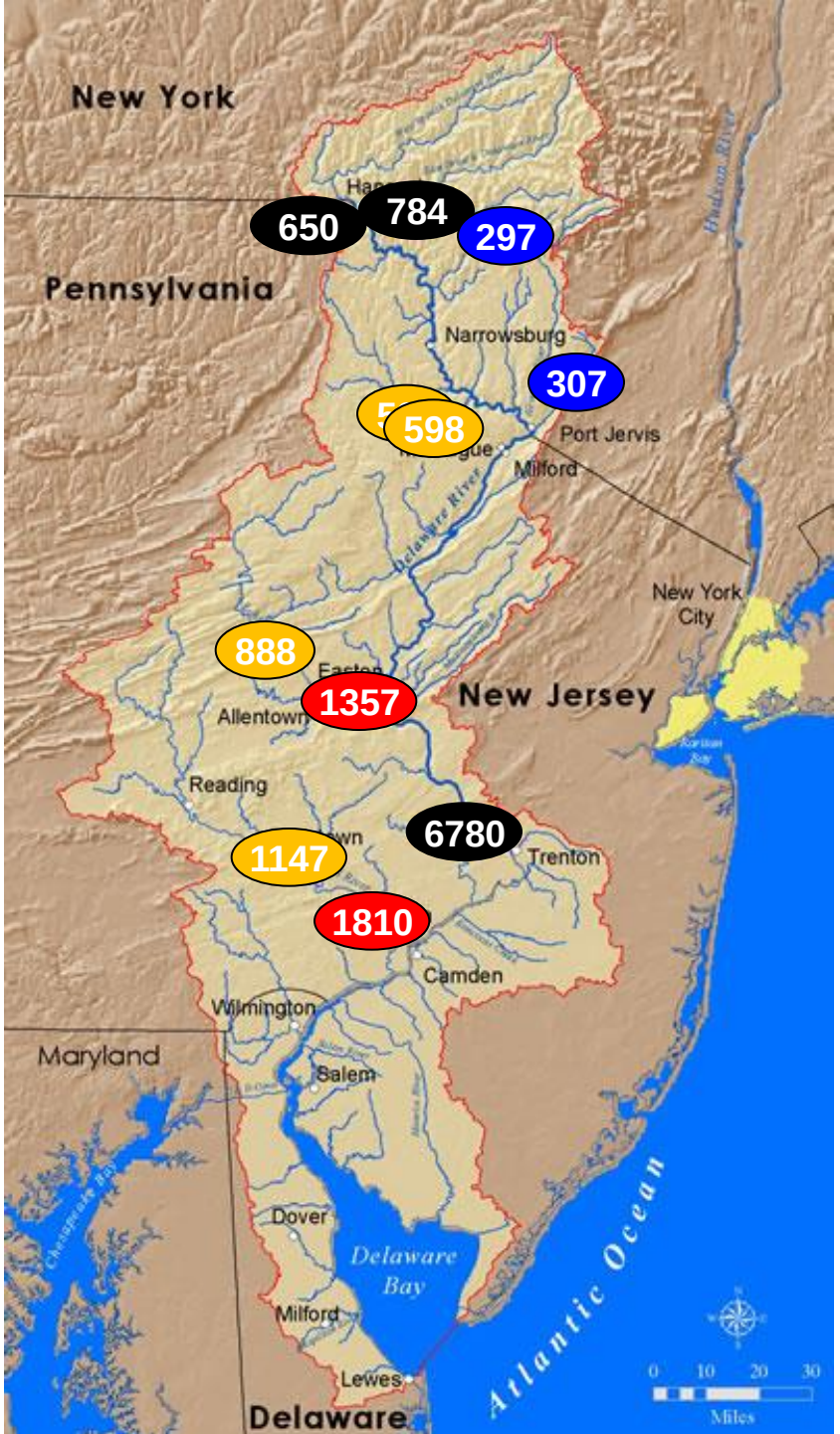
- **Basin comparisons: use stressor gradient on largest rivers**
- **Regional comparisons: back to mid-Atlantic / NE rivers**
- **Expert workshop (e.g., BCG scores)**
- **Historical: condition in 1960s (?)**

Stressor Gradient in the Delaware Basin

- 2010 collections by DRBC
- Span 300 to 1800 mi^2 drainages

- Reference Sites:
  - ✓ Beaver Kill
  - ✓ Neversink River

- Stressed Sites
  - ✓ Lackawaxen R: hydrology
  - ✓ Lehigh R: all major stressors
  - ✓ Schuylkill R: all major stressors



Biological Condition Gradient: Biological Response to Increasing Levels of Stress

Levels of Biological Condition

Natural structural, functional, and taxonomic integrity is preserved.

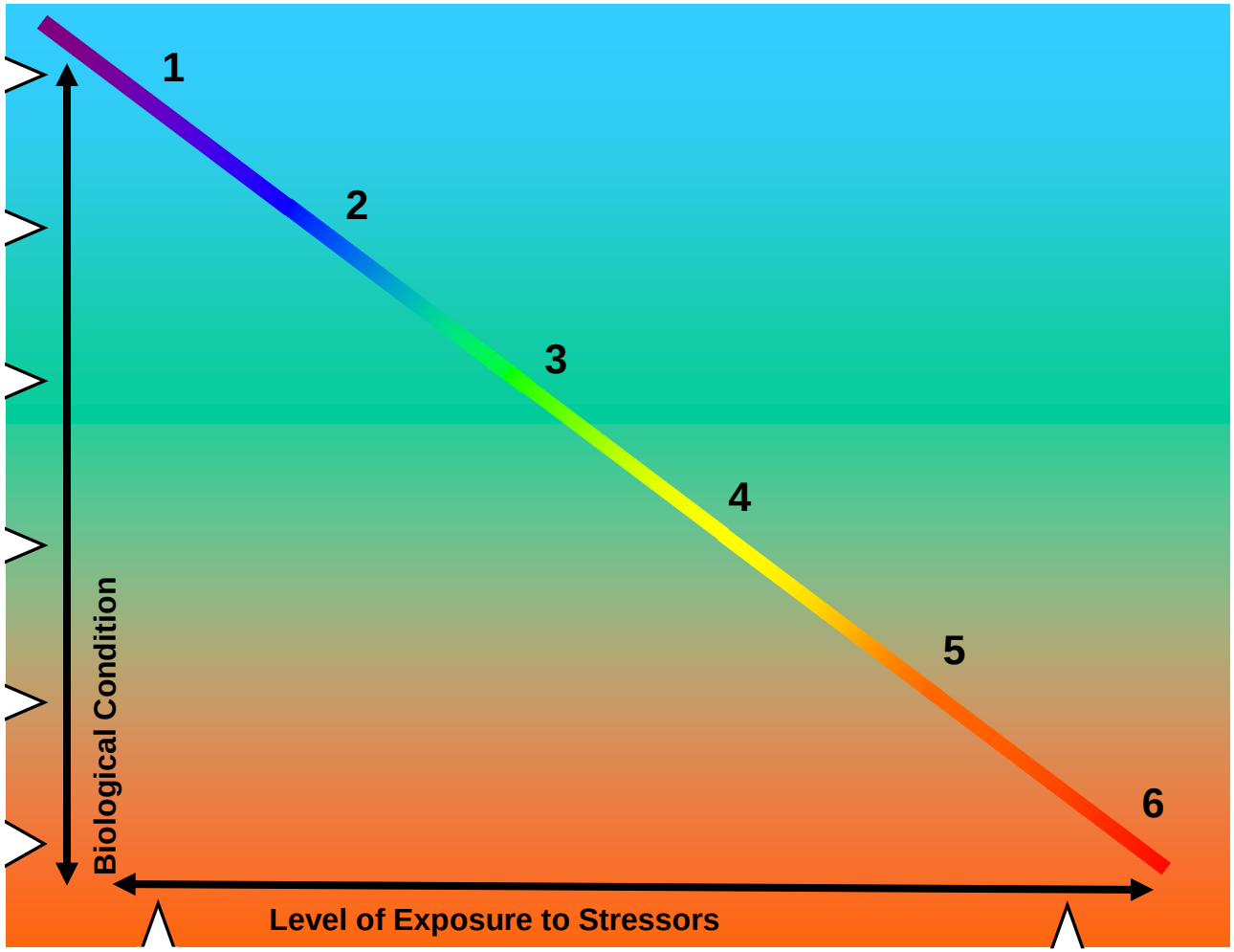
Structure & function similar to natural community with some additional taxa & biomass; ecosystem level functions are fully maintained.

Evident changes in structure due to loss of some rare native taxa; shifts in relative abundance; ecosystem level functions fully maintained.

Moderate changes in structure due to replacement of sensitive ubiquitous taxa by more tolerant taxa; ecosystem functions largely maintained.

Sensitive taxa markedly diminished; conspicuously unbalanced distribution of major taxonomic groups; ecosystem function shows reduced complexity & redundancy.

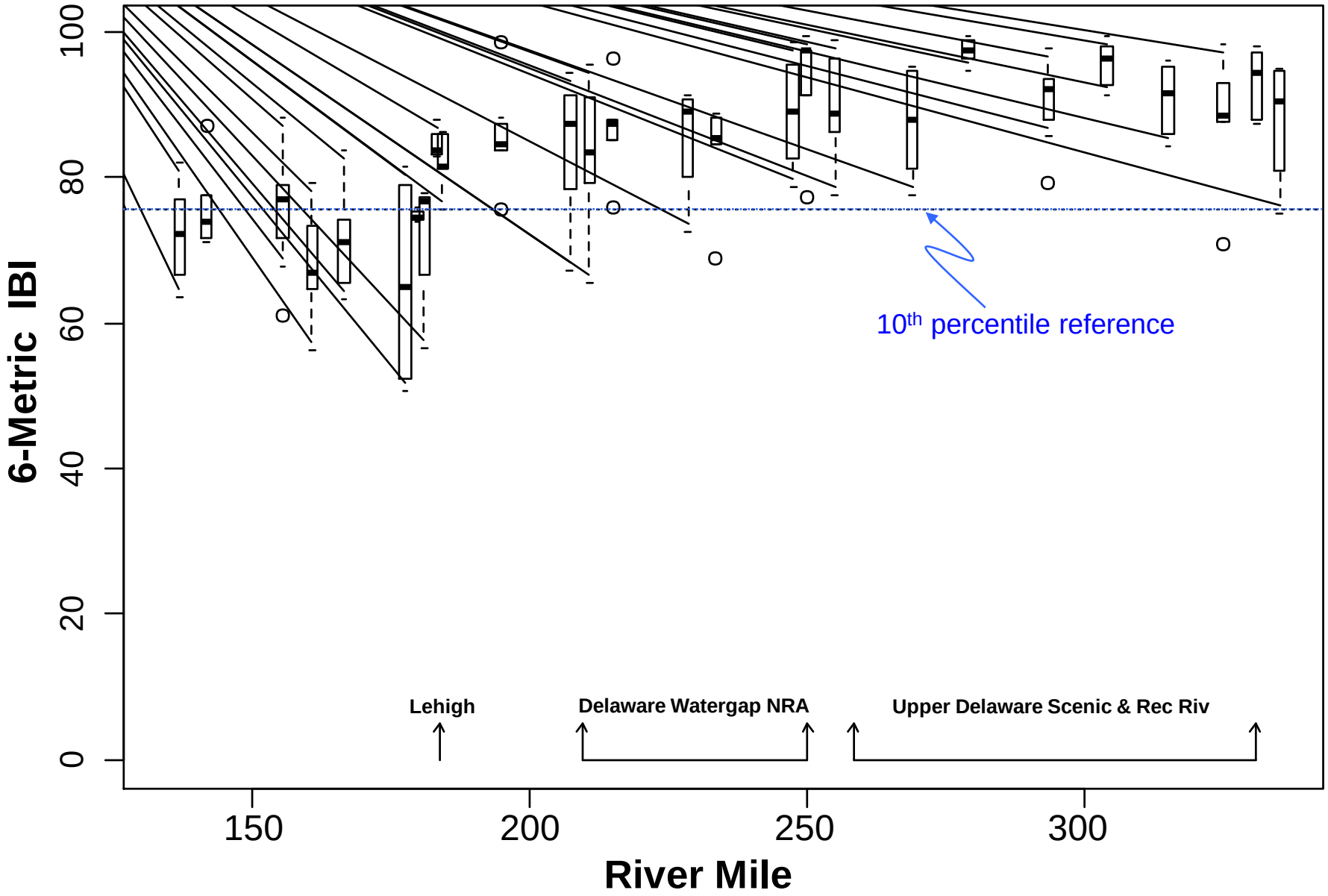
Extreme changes in structure and ecosystem function; wholesale changes in taxonomic composition; extreme alterations from normal densities.



Watershed, habitat, flow regime and water chemistry as naturally occurs.

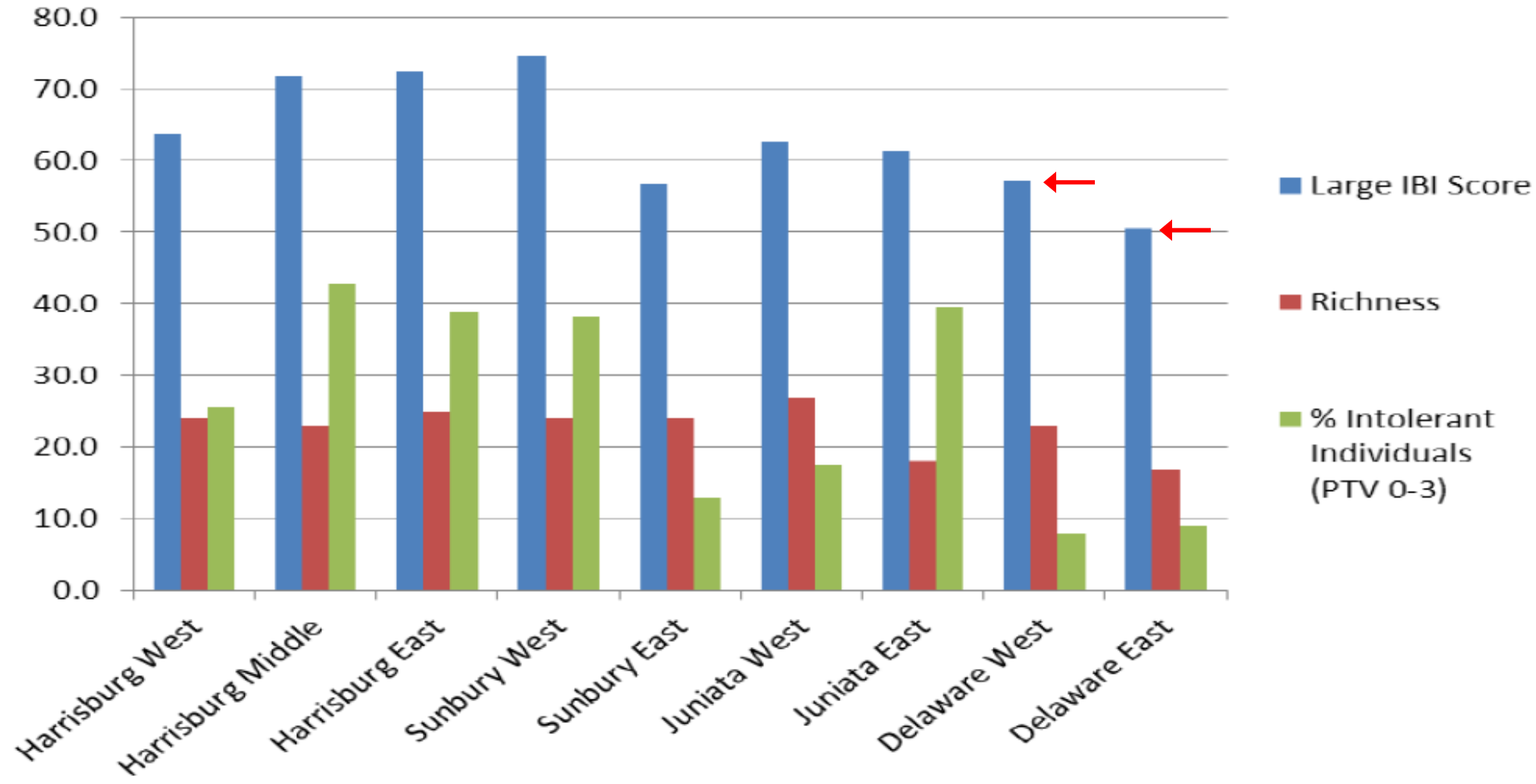
Chemistry, habitat, and/or flow regime severely altered from natural conditions.

Delaware R. Bioassessment Methodology: 6-metric IBI



PADEP Susquehanna River Study – 2012 Results

Benthic Macroinvertebrate Sampling



Conclusions

- Biological expectations difficult to define in unique settings and for systems that may be at the upper end of the stressor gradient
- Delaware R may be its own best reference at this time, with a predominance of “healthy” sites
- Selecting the right assessment tool will require appropriate evaluations of sites along a stressor gradient

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